ESA 2014 ABSTRACT – FINAL - Organized oral session presentation

Landscape patterns and disturbance legacies: Is a warming climate altering spatial patterns of wildfire severity and post-fire forest succession?

Brian J. Harvey, Zoology, University of Wisconsin, Madison, WI
Monica G. Turner, Zoology, University of Wisconsin, Madison, WI
Daniel C. Donato, Department of Natural Resources, WA

Background/Question/Methods:
In fire-prone forest landscapes, post-fire resilience (capacity to recover following fire) can be influenced by the spatial heterogeneity of wildfire. Burn-severity mosaics set the stage for post-fire succession, as the size and spatial arrangement of severely-burned (i.e., stand-replacing) patches strongly influence seed delivery required for forest reestablishment. Climate warming has been associated with increasing abundance, size, and severity of wildfires. However, little is known about whether the spatial patterns of wildfire severity are changing, or whether effects of burned-patch size and shape on post-fire succession may vary with climate conditions. Using remote sensing and field data, we asked whether the composition (e.g., proportion of fires that burned as stand-replacing) and configuration (e.g., size and shape of stand-replacing fire patches) of wildfires (n = 719) have changed between 1984 and 2010 in the Northern Rocky Mountains (USA). We also quantified effects of burned-patch size on post-fire tree seedling recruitment by sampling from the edge to the interior of stand-replacing fire patches (184 plots) in and near Glacier and Yellowstone National Parks. Plots were stratified among fires that were followed by anomalously warm/dry or cool/wet post-fire climate conditions to test if the effects of patch size vary with post-fire climate.

Results/Conclusions:
Between 1984 and 2010, the mean proportion of stand-replacing fire within wildfire perimeters increased from 25 to 30%, and the edge-to-area ratio of stand-replacing burn patches decreased from 800 to 750 m/ha. Other landscape metrics (e.g., mean patch size, amount of area >150 m from the edge of stand-replacing burn) showed no change over time. Tree recruitment rates into patches of stand-replacing fire differed by species; wind-dispersed conifers (e.g., *Picea engelmannii*) recruited near edges of burn patches, and seed-banking (e.g., *Pinus contorta*) and re-sprouting (e.g., *Populus tremuloides*) trees exhibited weaker distance-to-edge effects. Post-fire tree regeneration was greater in the moister Glacier landscape and lower in Yellowstone. Effects of distance-to-edge on post-fire tree regeneration were stronger in Yellowstone than in Glacier and for fires that were followed by subsequent warm/dry vs. cool/wet summers. Thus, effects of fire size and shape were exacerbated when climate conditions for tree establishment were more stressful. The proportion of severe fire has increased in recent years, but this has not been accompanied by major changes in spatial configuration. However, interacting effects of burn pattern and climate on post-fire succession suggests the importance of spatial patterns of burn severity will increase as climate continues to warm.